

# THE ACANTHOCEPHALA COLLECTED BY THE ALLAN HANCOCK PACIFIC EXPEDITION, 1934\*

(PLATES 51-55)

HARLEY J. VAN CLEAVE  
University of Illinois

Through the courtesy of Dr. H. W. Manter and Dr. Irene McCulloch, I have had the opportunity of studying the Acanthocephala which Dr. Manter collected when he accompanied the Hancock Pacific Expedition of 1934 to the Galapagos Islands. The collection, although relatively small, is of great significance because 4 new species of Acanthocephala have been encountered and further biological and distributional data have been added for 3 previously known species. All of the new forms encountered are from fish hosts. They are *Gorgorhynchus lepidus*, *Gorgorhynchus clavatus*, *Filisoma bucerium*, and *Tegorhynchus pectinarius*, which are described in this report. The forms for which additional data become available are *Nipporhynchus ornatus* (Van Cleave, 1918) from a fish host and *Southwellina hispida* (Van Cleave, 1925) and *Centrorhynchus spinosus* (Kaiser, 1893) from avian hosts.

In the course of this study it is pointed out that *Gorgorhynchus gibber* is a synonym of *G. medius*, so the latter becomes type of the genus. Similarly, it is shown that *Nipporhynchus katsuwonis* is a direct synonym of *N. ornatus*, whereby *ornatus* becomes the type of *Nipporhynchus*.

## Genus **GORGORHYNCHUS** Chandler, 1934

Chandler (1934, p. 356) applied the name *Gorgorhynchus* to a generic concept based on *Rhadinorhynchus medius* (Linton, 1907) and on *G. gibber*, which he designated as type of the genus and described in the same paper. In his original description, Chandler expressed the feeling that *G. gibber* and *G. medius* resemble each other so closely that "there might even be some question of their specific distinctness." In establishing the status of *G. gibber*, he made numerous comparisons with observations on *G. medius* published by Linton (1907), and, although he showed that some of Linton's observations were in error, he proceeded

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to justify his new species on differences that he observed between his own material and the description of Linton. The present writer has access to some of the cotypes of *G. medius*. These include the two specimens that were restudied in 1918 when *medius* was reassigned to the genus *Rhadinorhynchus* and three additional individuals that had been preserved in alcohol but are now stained and mounted for microscopical study. Measurements and other observations taken on this cotype material fail to agree with the data cited by Linton in the original characterization of the species.

The original description of *G. medius* gives 45  $\mu$  as length of the hooks on the base of the proboscis. On the cotypes these measure 59 to 70  $\mu$ , thus including the 70  $\mu$  cited by Chandler for *G. gibber*. Likewise, other hooks on the proboscis of *G. medius* were recorded as 60  $\mu$  while reaching 70 to 80  $\mu$  in *G. gibber*. Most of the hooks measured on the cotypes of *G. medius* were at least 70  $\mu$  long. Similarly, the spines on the body were recorded as distinctly larger in *G. gibber*, but spines 60  $\mu$  were very common on the cotypes of *G. medius*, thus eliminating spine size as a possible specific difference. In like manner, the cited range of hook formulas for the two presumed species does not fall beyond the range of individual variability commonly encountered in Gorgorhynchidae. Linton cited "about 22 ventral rows of hooks," while Chandler listed an unqualified 22 for *medius* and cited 24 for *G. gibber*. Bodily measurements and proportions cited in Chandler's comparison of the two presumed species are not sufficient ground on which to base specific distinction when other more stable characters, not affected by growth stages, are removed from the list of differences.

On the basis of the foregoing analysis the present writer is convinced that *G. gibber* must be considered as a direct synonym of *G. medius* (Linton, 1907). Since *G. gibber* had been cited as genotype by original designation, its valid synonym *G. medius* (Linton, 1907) becomes the type of the genus *Gorgorhynchus*. In a paper now in press (Van Cleave and Lincicome), the genus *Gorgorhynchus* is separated from the family *Rhadinorhynchidae* and is designated as type of a new family *Gorgorhynchidae*, separable from the *Rhadinorhynchidae* chiefly on the basis that the *Gorgorhynchidae* have males with four cement glands, while the *Rhadinorhynchidae* have males with eight cement glands.

Two distinct species of *Gorgorhynchus* were taken from marine fishes of Albemarle Island by the Hancock Expedition. These are described in the following section.

*Generic diagnosis.* The genus *Gorgorhynchus* includes species parasitic in marine fishes. Body elongate and usually slender, somewhat expanded anteriorly. Body spines in a single field at the anterior extremity of the body. Proboscis cylindrical or barrel shaped, relatively stout, densely armed with numerous hooks arranged in quincunxial order of alternating longitudinal and circular rows not showing profound regional or dorsoventral differentiation. Proboscis receptacle double walled with the brain well forward toward its anterior end. Lemnisci long, slender. Male genitalia occupy more than the posterior half of the body with the testes just posterior to the widest part of the body. Testes usually separated some distance and followed by four extremely long, tubular cement glands.

*Type species.* *Gorgorhynchus medius* (Linton, 1907).

### ***Gorgorhynchus lepidus*, new species**

(Plate 51, figs. 1-5)

*Host:* *Cratinus agassizii* Steindachner, Tagus Cove, Albemarle Island, Galapagos, January 14, 1934.

*Types.* Eleven specimens (5 males and 6 females). Holotype male (VC 3126.6) and allotype female (VC 3126.7) and series of paratypes in the Allan Hancock Foundation of The University of Southern California. Paratypes also deposited in the collection of H. J. Van Cleave, Urbana, Illinois, and of the U.S. National Museum.

*Specific diagnosis.* No fully mature individuals available. Body of immature specimens 7 to 10 mm long with greatest diameter (0.8 to 0.9 mm) posterior to the tip of the proboscis receptacle. Posterior region of body much reduced in diameter (about 0.4 mm). Anterior region of body closely set with spines in a single continuous field which on the ventral surface extend from one half to three fourths the length of the receptacle but on the dorsal surface from one fourth to one half the length of the receptacle. Spines 65 to 90  $\mu$  long, often with a root process extending anteriorly from the base of the spine. Proboscis large, somewhat barrel shaped with greatest diameter (0.46 to 0.5 mm) near the middle tapering slightly toward each end; 1.6 to 0.8 mm long, armed with 20 longitudinal rows of 14 to 16 hooks each. Near middle of proboscis the ventral hooks are 106 to 120  $\mu$  long, dorsal hooks in corresponding location 96 to 118  $\mu$  long; those on ventral surface usually much heavier. Proboscis receptacle 1.7 to 2.2 mm long with the brain

near its anterior end at a level near the anterior limit of the body spination. Lemnisci very long, at times more than three times the length of the receptacle, one usually considerably longer than the other. A small rounded papilla (figs. 2 and 3) 20 to 23  $\mu$  in diameter on each lateral surface of the proboscis, slightly anterior to the level of the posteriormost hooks lying between adjacent longitudinal rows of hooks and slightly modifying the hook arrangement.

Testes ovoid, about 0.3 mm long, in some individuals contiguous but more often separated by a distance equal to 1.5 times the length of a testis. Cement glands 4, very long, tubular. Genital orifice of female usually slightly dorsal, subterminal, associated with a slight posterodorsal extension of the body. Embryos not available.

*Comparisons.* *G. lepidus* differs from *G. medius* in that the former has fewer longitudinal rows of hooks as well as fewer hooks in each row, but the hooks are distinctly larger than in *G. medius*. Comparing *G. lepidus* with *G. clavatus*, which is described in this same paper, the latter has conspicuously fewer hooks in each longitudinal row, and the hooks are distinctly larger than in *G. lepidus*.

### **Gorgorhynchus clavatus**, new species

(Plate 52, figs. 6, 7; Plate 54, fig. 16)

Host: *Paralabrax humeralis*, Tagus Cove, Albemarle Island, Galapagos, January 13, 1934.

*Types.* Description based on 5 individuals and a few additional fragments. Holotype female (VC 3127.1) and allotype male (VC 3127.5) in the Allan Hancock Foundation of The University of Southern California. Paratypes in the collection of H. J. Van Cleave, Urbana, Illinois, and in the U.S. National Museum.

*Specific diagnosis.* Mature females about 26 mm long, body very heavy, 1.8 to 2.4 mm in greatest diameter, tapering gradually to 1.5 to 1.8 mm posteriorly. (Males, body broken; hence, entire length not observable.)

Body spines arranged in a single field, extending almost as far posteriorly on dorsal as on ventral surface; ventrally one half to three fifths the length of the receptacle; dorsally one fourth to two fifths the length of the receptacle. Body spines 48 to 84  $\mu$  long.

Proboscis cylindrical, reduced by slight rounding at either extremity, 1.25 to 1.5 mm long by 0.51 to 0.58 mm in maximum diameter; armed with 20 longitudinal rows of 13 to 15 hooks each. Longest hooks, near

anterior end of proboscis, 120 to 142  $\mu$  long on ventral surface, those on dorsal somewhat shorter. One small papilla (sensory?) on each mid-lateral surface of the proboscis at the level of the basal hooks and influencing the arrangement of adjacent basal hooks as described for *G. lepidus*.

Lemnisci very long, in some as much as two and one-half times the length of the receptacle.

Proboscis receptacle in mature females 3.23 mm long, with brain located about one third the distance from its anterior extremity.

Testes contiguous, about 1.5 mm long.

Mature embryos within body of female 105 to 120  $\mu$  long by 36 to 43  $\mu$  wide.

Among some broken specimens of *G. clavatus* were found the terminal regions of male and female in copula. This condition is so relatively unusual in preserved material that a drawing of the stained whole mount is shown as fig. 16 on Plate 54.

*Comparisons.* *Gorgorhynchus clavatus* differs from *G. medius* in that there are fewer hooks on the proboscis of *G. clavatus*. This applies to both the number of longitudinal rows and the number in each row. The largest hooks in *G. clavatus* are nearly twice the size of those found in *G. medius*. The chief point of difference between *G. clavatus* and *G. lepidus* is the fact that the proboscis hooks of the former are considerably larger than those of *G. lepidus*.

Both *G. clavatus* and *G. lepidus* have as hosts marine fishes of the family Serranidae or sea basses. The host from which Linton reported *G. medius* belongs to a genus which is placed in the family Epinephelidae adjacent to the Serranidae. These forms seem to be the natural hosts of members of the genus *Gorgorhynchus*, although Chandler (1924) found this genus in *Galeichthys*, a marine catfish, belonging to an entirely different order of the fishes.

### Genus *TEGORHYNCHUS* Van Cleave, 1921

The genus *Tegorhynchus* was recognized by the present author in 1921 to accommodate a species of acanthocephalon encountered in a marine fish of Masa Tierra of the Juan Fernandez Islands off the coast of Chile. As shown by Van Cleave and Lincicome (in press), this genus belongs in the family *Gorgorhynchidae*. It is closely related to the genus *Illiosentis* Van Cleave and Lincicome.



*Generic diagnosis.* Gorgorhynchidae of small to medium size with body spination in an uninterrupted mantle restricted to the anterior part of the body. Proboscis long, relatively few longitudinal rows of hooks. The entire proboscis invested by a thick hyaline cuticular membrane or the individual hooks ensheathed in prominent cuticular elevations of the proboscis surface. Proboscis receptacle double walled. Brain near anterior extremity of receptacle. Lemnisci at least as long as the receptacle. Testes contiguous followed by four clavate cement glands. Parasitic as adults in intestine of marine fishes.

*Type species.* *Tegorhynchus brevis* Van Cleave, 1921.

In the parasitic worms collected by the Allan Hancock Pacific Expedition of 1934, 2 specimens represent a previously unknown species which is assigned to this genus and is named *Tegorhynchus pectinarius*.

### ***Tegorhynchus pectinarius*, new species**

(Plate 52, figs. 8, 9)

Host: Medialuna (?) taken from stomach of *Seriola* sp., Puerto Culebra, Costa Rica, February 24, 1934.

*Types.* Description based on 2 females, one of which, designated as holotype (VC 3124.2), is deposited in the Allan Hancock Foundation of The University of Southern California and the other, as a paratype, is deposited in the collection of H. J. Van Cleave, Urbana, Illinois.

*Specific diagnosis.* Body slightly fusiform, anterior extremity clothed with scattered spines about 30 to 48  $\mu$  long, not disposed in distinct zones but extending backward as a continuous mantle along almost three fourths the length of the body. Body proper 8.4 to 8.8 mm long. Proboscis, fully extended, about 1.4 mm long; armed with 12 longitudinal rows of about 28 to 30 hooks each (see figs. 8 and 9), the hooks displaying profound regional differentiation. A series of 6 or 7 hooks at the base of each longitudinal row forms a closely set, comblike series of thorns (fig. 9). The thorns of these combs are arranged in check rows in both directions, not in the alternating quincunxial order characteristic of the hook arrangement on the anterior region of the proboscis. Besides this regional specialization involving the base of the proboscis there is a conspicuous dorsoventral differentiation of the proboscis. Each of the 4 middorsal rows of hooks has one very heavy, strongly recurved hook with an exaggerated root standing immediately anterior to the basal comb. These peculiarly modified heavy hooks have a length of about 27  $\mu$ , while the large, recurrent root is almost twice the length of the hook proper. In



the 2 dorsalmost rows, either the space immediately anterior to the hook with the enlarged root is entirely devoid of hooks, or the hooks are represented by poorly formed vestiges for a space corresponding to the positions of 4 hooks in adjacent longitudinal rows. The third row from the median dorsal line of the proboscis on each lateral surface possesses a basal comb containing 5 thorns, one less than in the 4 dorsal combs. In these third rows from the middorsal surface, a single enlarged thorn occupies a position comparable to the location of the heavily rooted hooks in the dorsal series. A single thorn, slightly detached from the comb series, lies between the comb and the hook standing on the same level as the hooks with enlarged roots. In this same third row from the median dorsal plane on the lateral surface of the proboscis, the location of the vestigial hooks of the dorsal series is occupied by 2 very heavy hooks with heavy roots, but the roots are approximately  $40\ \mu$  long with the recurved hook portion  $27\ \mu$  long. The 6 ventral rows of hooks show very little regional specialization. In these, the basal comb of 6 or 7 thorns is followed anteriorly by 2 very heavy, thornlike hooks, of which one serves as transition to the form of the long, arcuate hooks characteristic of the anterior region of the proboscis. Anterior to the various characteristic basal modifications, the remaining hooks show little regional differentiation, except that hooks on the ventral surface are somewhat heavier and more strongly recurved than those on the corresponding region of the dorsal surface. The hyaline cuticular membrane surrounding the proboscis is not so pronounced as in *Tegorhynchus brevis* but surrounds each hook in a sheath much as in the genus *Leptorhynchoides*.

Lemnisci very thin and much coiled, apparently a little longer than the length of the receptacle.

Embryos within one gravid female  $84$  to  $93\ \mu$  long by  $21$  to  $24\ \mu$  wide. Males not observed. Genital extremity of female rather bluntly truncated, with genital orifice posterior but near the dorsal edge of the posterior end.

*Comparison.* *T. pectinarius* differs from *T. brevis*, the only other known member of the genus in (1) the extreme regional specialization of its proboscis hooks, (2) the number of hooks on the proboscis, and (3) the size of the embryos.

### Genus *FILISOMA* Van Cleave, 1928

The genus *Filisoma* was proposed by the present writer for a concept based on *Filisoma indicum*, a species found in the intestine of a fish,

*Scatophagus argus*, from India. In males of the type material, the cement glands were described as "very long, individual glands not recognizable." The writer was then of the impression that these glands are syncytial, as in the Neoechinorhynchidae, but the lack of giant nuclei in the subcuticula and the presence of a double-walled proboscis receptacle gave conclusive evidence that *Filisoma* cannot be considered as belonging to the order Eoacanthocephala. Meyer (1933) without further evidence than that presented in the description of the type species ascribed *Filisoma* to the family Rhadinorhynchidae. A preliminary examination of materials in the collections of the Hancock Pacific Expedition revealed worms of an undescribed species which obviously belongs to the genus *Filisoma*. In the males of these specimens, 4 elongate cement glands characteristic of the family Gorgorhynchidae (Palaeacanthocephala) are observable. The cement glands have numerous relatively large nuclei such as are found in the genus *Gorgorhynchus*, but these are much more numerous and much smaller than the giant nuclei characteristic of the cement glands and subcuticula of the Eoacanthocephala. On the basis of the foregoing observations upon this previously unknown species, Van Cleave and Lincicome (in press) have assigned the genus *Filisoma* to the family Gorgorhynchidae within the order Palaeacanthocephala.

Recently, Harada (1938) has described another species which he ascribed to *Filisoma* as *F. microcanthi*, but, since males were lacking in his material, he could not offer additional evidence for the assignment of the genus beyond that given in the original incomplete description of *F. indicum*.

*Generic diagnosis.* Gorgorhynchidae parasitic in marine fishes. Body very long, slender, approximately cylindrical in preserved specimens, without body spination. Proboscis very long, cylindrical, arcuate. Proboscis receptacle very long, double walled, with brain at its base. Retinacula at posterior tip of receptacle. Lemnisci about the same length as the receptacle. Male genitalia widely separated from the receptacle of the proboscis. Testes several times as long as wide, followed by four extremely long cement glands.

*Type species.* *Filisoma indicum* Van Cleave, 1928.

### ***Filisoma bucerium*, new species**

(Plate 53, figs. 10-14)

Host: *Kyphosus elegans* (Peters), Socorro Island, Mexico, January 3, 1934.



*Types.* Description based on 10 individuals (6 males, 4 females) of which one male (VC 3125.2) designated as holotype and 2 paratypes are deposited in the Allan Hancock Foundation of The University of Southern California; allotype female (VC 3125.1) and 2 paratype males in the collection of H. J. Van Cleave, Urbana, Illinois; and one male and one female paratype in the U.S. National Museum.

*Specific diagnosis.* Gorgorhynchidae without body spines. Mature females about 60 mm long, males about 45 mm. Body very much attenuated, slightly enlarged just posterior to the posterior tip of the receptacle, in females about 0.6 to 1 mm in diameter for most of its length; in males about 0.4 to 0.6 mm. Proboscis long, cylindrical, about 1.5 to 2 mm long, slightly to strongly arcuate, armed with 16 longitudinal rows of 38 to 45 hooks each. The median dorsal row of hooks differentiated from all the remainder in that they lack sharp points but each ends in a blunt tip of hornlike appearance. Near the middle of the length of the proboscis the ventral hooks are stout, sharp, strongly recurved, about  $57\ \mu$  long and  $21\ \mu$  in diameter at the base; on the dorsal surface hooks in the median row are bluntly pointed,  $57\ \mu$  long,  $21\ \mu$  in diameter at base; dorsal but lateral to the median row the hooks are simple, slender, sharp pointed, about 43 to  $51\ \mu$  long by  $9\ \mu$  in diameter at base. Papillae not observed on neck or proboscis. Proboscis receptacle double walled, very long (2.3 mm to 4.2 mm), with brain located at base and retinacula emerging from its posterior tip. Lemnisci fairly heavy, often almost as broad as receptacle, approximately the same length as receptacle.

Male genitalia restricted to approximately the posterior half of the body. The 2 testes elongate, slightly separated, followed by a series of 4 very long, tubular cement glands.

Posterior extremity of female obliquely truncated in posterior-dorsal area, with the female orifice subterminal on the dorsal surface. Embryos within body cavity of mature female 56 to  $69\ \mu$  long by 12 to  $18\ \mu$  wide.

*Comparison.* *F. bucerium* differs from the other 2 species of the genus *Filisoma* in the presence of one middorsal longitudinal row of conspicuously modified, heavy, blunt, hornlike proboscis hooks and in the possession of a larger number of hooks in each longitudinal row than in any other species.

Of the 2 previously described species, *F. indicum* has been recorded from India only, while *F. microcanthi* rests on a single record from Formosa. *F. bucerium* is the first species described from the Western Hemisphere.

Genus **NIPPORHYNCHUS** Chandler, 1934

Chandler (1934, p. 355) recognized *Nipporhynchus* as a new genus based on the concept of *Rhadinorhynchus katsuwonis* Harada, 1928. To this genus he tentatively ascribed *R. ornatus* Van Cleave, 1918, because details of structure were too imperfectly known to warrant unqualified assignment of the species in his new series of generic concepts. A number of specimens in the collections of the Hancock Pacific Expedition agree with the original material of *R. ornatus*. Fortunately, among these one male individual is included. Since males were previously unknown and since some of the most stable generic characters in this family rest on characteristics of the male, this material offers the first opportunity for confirming Chandler's tentative assignment of *R. ornatus* to the genus *Nipporhynchus*.

Previously, the only concept of *R. ornatus* was based on the rather inadequate description given by Linton (1892). The discovery of additional specimens in the Hancock Expedition collections enables the writer to give a more comprehensive description of this species. In doing so it has become evident that *Nipporhynchus katsuwonis*, described as a new species by Harada (1928), cannot be differentiated from *N. ornatus* and must fall as a synonym. Detailed comparisons on which this conclusion is based are shown in Table I. Since Chandler (1934) had cited *N. katsuwonis* as genotype by original designation, its valid synonym *N. ornatus* (Van Cleave, 1918) becomes the genotype of *Nipporhynchus*.

The present writer cannot agree with the position of Yamaguti (1938, p. 271), who states "There is no sound reason for separating this species [*R. katsuwonis*] from *Rhadinorhynchus* Lühe, 1911, as type of *Nipporhynchus* Chandler, 1934." The genus *Nipporhynchus* is a valid concept under the family Gorgorhynchidae as expressed by Van Cleave and Lincicome (in press).

*Generic diagnosis.* Gorgorhynchidae with long proboscis, armed with many longitudinal rows of hooks which are longer and stouter on ventral surface than on dorsal, basal row forming a complete circle. Proboscis receptacle double walled. Anterior body region beset with spines which may be in a single or double field. Lemnisci ribbon shaped, about as long as proboscis receptacle. Testes elongate. Cement glands 4 in number, elongated, cylindrical or club shaped, and may be paired.

*Type species.* *Nipporhynchus ornatus* (Van Cleave, 1918).

The only representative of this genus encountered in this study is the genotype.

TABLE I

Comparison of *Nippoerhynchus katsuwonis* and *N. ornatus*

	<i>N. katsuwonis</i> after Harada, 1928	<i>N. ornatus</i> after Van Cleave
Body length, females	up to 35 mm	about 25 mm
Body length, males	up to 17 mm	about 17 mm
Proboscis dimensions	1.8 to 2.4 mm by 0.2 mm	2 to 2.5 mm by 0.23 mm
Proboscis hooks	22 rows of 32 to 39 each	22 to 24 rows of 38 to 45 each
Proboscis hook size	55 to 60 $\mu$	50 to 80 $\mu$
Basal hooks on proboscis	circle of 22; 100 $\mu$	circle of 22 (to 24); 82 to 100 $\mu$
Body spines	50 to 60 $\mu$	48 to 74 $\mu$
Brain	Slightly anterior to middle of receptacle	2/5 way from anterior end of receptacle
Lemnisci	slightly shorter than receptacle	slightly shorter than receptacle
Cement glands	4	4
Male genitalia	Posterior half of body	Posterior half of body
Embryos	65 to 80 $\mu$ by 21 to 25 $\mu$	59 to 69 $\mu$ by 20 to 24 $\mu$
Hosts	<i>Euthynnus vagans</i>	<i>Euthynnus alletteratus</i> <i>Katsuwonis pelamis</i> <i>Tylosurus acus</i>

**Nipporhynchus ornatus** (Van Cleave, 1918)

(Plate 54, fig. 15; Plate 55, fig. 18)

Synonymy: *Echinorhynchus pristis* (in part) of Linton, 1892*Rhadinorhynchus ornatus* Van Cleave, 1918*Rhadinorhynchus katsuwonis* Harada, 1928*Nipporhynchus katsuwonis* (Harada, 1928) Chandler, 1934Hosts: *Euthynnus alletteratus* (Raf.), Charles Island, Galapagos, January 27, 1934*Katsuwonis pelamis* (Linn.), Charles Island, Galapagos, January 30, 1934*Euthynnus alletteratus* (?) or *Katsuwonis pelamis* (Linn.), Galapagos Islands, June 11, 1934

*Specific diagnosis.* Fully mature females about 25 mm long, with maximum diameter of about 0.7 mm, tapering toward either extremity to a diameter of about 0.5 mm. Male about 17 mm long with a diameter of about 0.6 in region of the testes. Proboscis cylindrical to clavate, 2 to 2.5 mm long by about 0.23 mm in diameter, often with a slight swelling near anterior tip; armed with 22 to 24 longitudinal rows of 38 to 45 hooks each. Hooks of basal circle approximately 82 to 100  $\mu$  long, without any specialized ventral crescent; on mid-ventral surface of proboscis about 59  $\mu$ ; on middorsal more slender; near anterior end about 76  $\mu$  long. Testes contiguous; cement glands 4, long, tubular. Lemnisci distinctly shorter than proboscis receptacle. Body spines arranged as a collar of scattered spines on anterior body extremity followed by an unspined area and then with scattered spines, chiefly on ventral surface but not extending posteriorly as far as the end of the proboscis receptacle. Spines about 76  $\mu$  long. Retinacula about three fifths the length of the proboscis receptacle from its posterior end. Embryos within body of gravid female 59 to 69  $\mu$  long by 20 to 24  $\mu$  in diameter.

The geographical range of this species has been greatly extended by this record. Previously known only from northeastern United States, the species is here recorded from Charles Island of the Galapagos group. The species evidently has wide range of host relationships. The present record is the first instance of description of a male of this species.

**Southwellina hispida** (Van Cleave, 1925) Witenberg, 1932  
(Plate 54, fig. 17)

Synonymy: *Arhythmorhynchus hispidus* Van Cleave, 1925  
*Arhythmorhynchus fuscus* Harada, 1929

Host: An undetermined heron, Indefatigable Island, Galapagos,  
January 20, 1934

Under the name *Arhythmorhynchus hispidus*, the writer (1925) described 5 specimens of immature worms taken from mesenterial cysts of *Rana nigromaculata* of Musashi Province, Japan. In 1929, Fukui described the adult of this species from the intestine of *Nycticorax nycticorax* (Linn.) from Shizuoka Province. In the same year, Harada described apparently the same species as *Arhythmorhynchus fuscus* from the same host as recorded by Harada. Fukui (1929, p. 270) and Yamaguti (1935, p. 269) both list *A. fuscus* as a direct synonym of *A. hispidus*, while the latter accepted the proposal of Witenberg (1932), who recognized this species as genotype of his new genus *Southwellina*, changing the termination of the specific name to agree with the gender of the generic name. The valid name thus became *Southwellina hispida* (Van Cleave, 1925).

To date, all published records of the occurrence of this species have been confined to hosts taken in Japan. It was with some surprise that the author encountered 4 specimens (2 males and 2 females) of this species in material removed from the intestine of an unidentified heron on Indefatigable Island, January 20, 1934. The species probably has broad geographical distribution that has not yet been adequately understood.

**Centrorhynchus spinosus** (Kaiser, 1893)  
(Plate 55, figs. 19, 20)

Synonymy: *Echinorhynchus spinosus* Kaiser, 1893  
*Centrorhynchus spinosus* Van Cleave, 1916

Host: "Galapagos hawk," Galapagos Islands, January 22, 1934

*Echinorhynchus spinosus* was originally described by Kaiser from an unrecorded host from Florida. The present writer (Van Cleave, 1916), misinterpreting Kaiser's description, described and renamed the same species *Centrorhynchus spinosus*. Several birds, all from Florida, have been listed as hosts for this species.

A fine series of 22 specimens from an unidentified Galapagos hawk have been identified as *C. spinosus*. In these the body of mature females ranges from 15 to 22 mm long with a conspicuous inflation of the anterior third or fourth of the body in mature worms but occupying more than one half the body length in immature individuals (fig. 19). Proboscis longer than originally described for this species (1 to 1.3 mm). Hooks in 30 to 34 longitudinal rows of 22 to 24 hooks each from 36 to 60  $\mu$  long. Embryos within gravid females 50 to 60  $\mu$  long by 20 to 24  $\mu$  wide.



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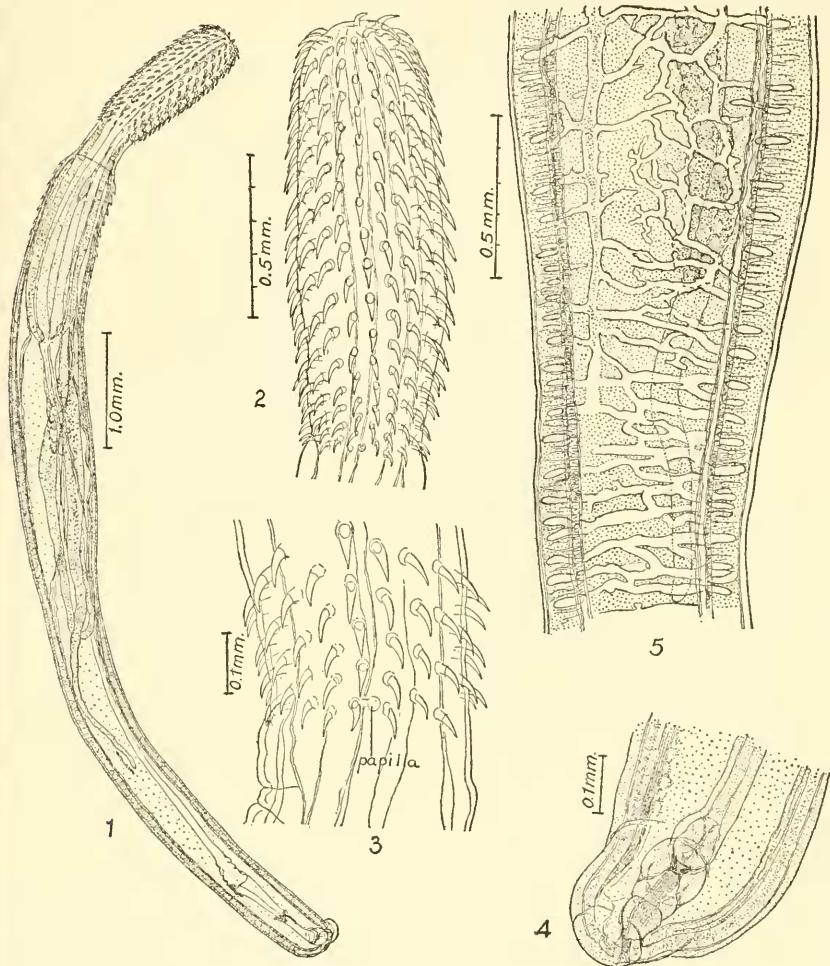
## EXPLANATION OF PLATES

All drawings are from stained, permanent mounts in balsam and were made by the use of a camera lucida.

## PLATE 51

*Gorgorhynchus lepidus*, new species

- FIG. 1. Immature female, entire, showing general organization and relation of the proboscis and related structures to the body.
- FIG. 2. Proboscis of a young female showing its form and arrangement of the hooks.
- FIG. 3. Detail of basal region of proboscis of a young male showing particularly the small papilla in the basal row of hooks.
- FIG. 4. Posterior extremity of an immature female showing part of the uterus, the vagina, and genital orifice.
- FIG. 5. Detail of a portion of body wall showing in lateral view the arrangement of vessels of lacunar system.



## PLATE 52

*Gorgorhynchus clavatus*, new species, and *Tegorhynchus pectinarius*, new species

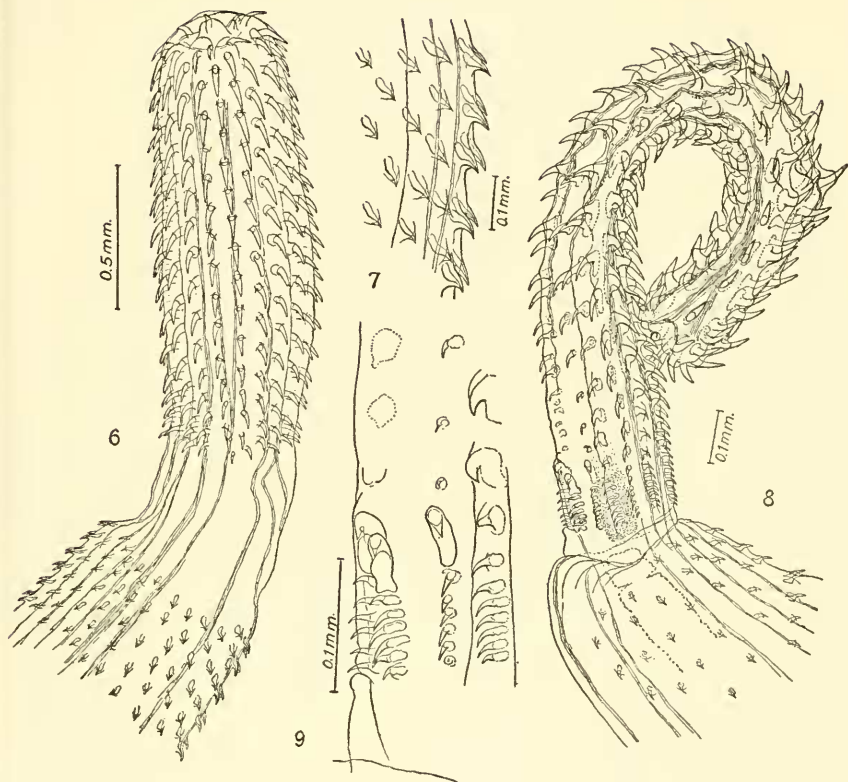
FIG. 6. *G. clavatus*, proboscis of mature female showing arrangement of hooks and attachment to body.

FIG. 7. *G. clavatus*, detail of anterior dorsal surface of body showing shape and arrangement of cuticular spines.

FIG. 8. *T. pectinarius*, anterior region of body and proboscis showing particularly the high degree of regional differentiation of proboscis hooks and cuticular sheaths around hooks.

FIG. 9. *T. pectinarius*, detail of basal region of proboscis, dorsal surface showing modifications of hooks.

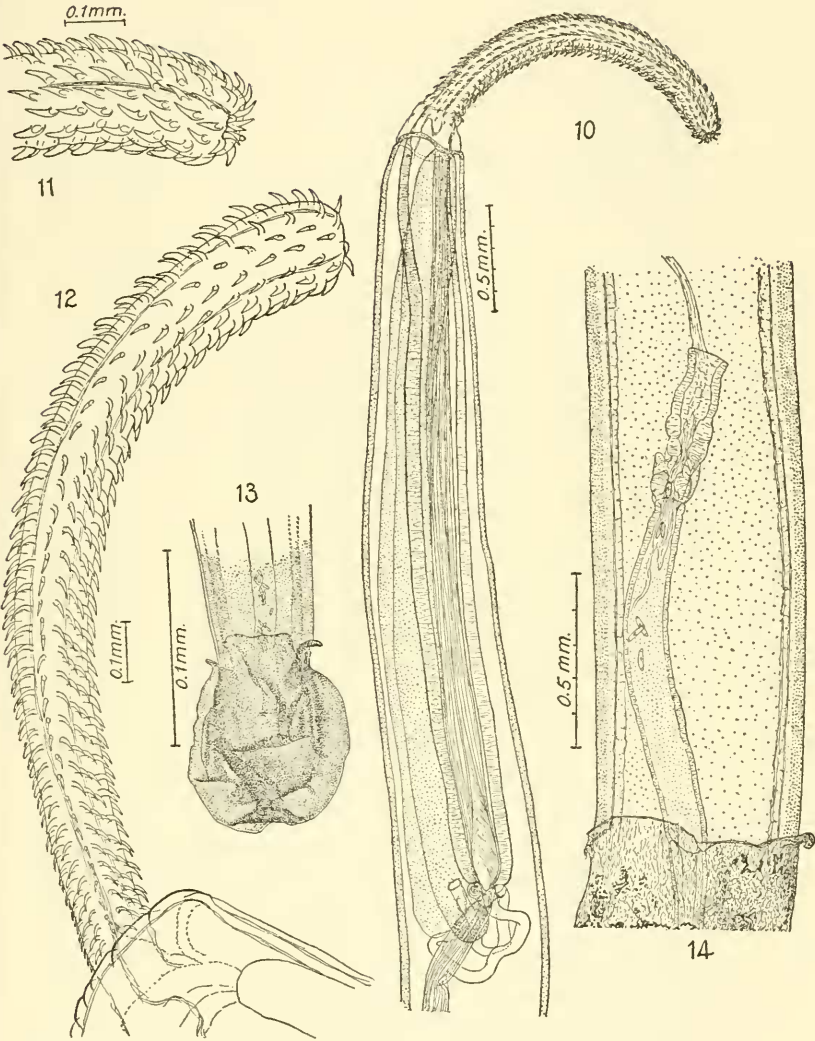




## PLATE 53

*Filisoma bucerium*, new species

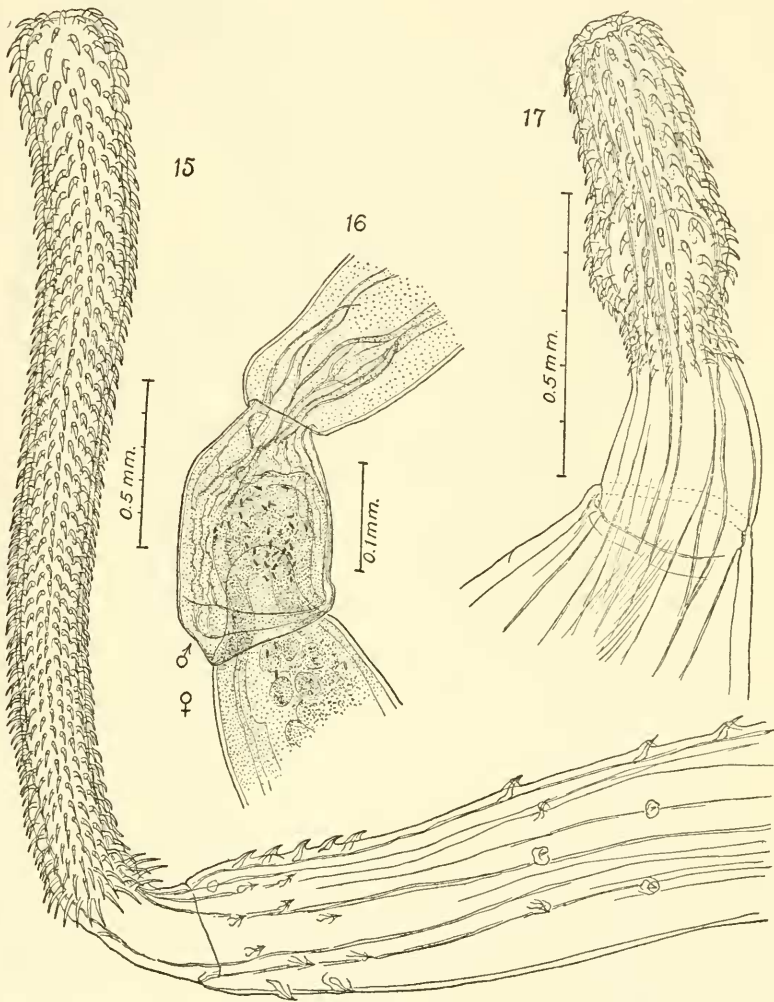
- FIG. 10. Anterior extremity of male showing relations of proboscis to the body, the receptacle of the proboscis and associated structures, and the lemnisci.
- FIG. 11. Detail of tip of same proboscis as shown in Fig. 10.
- FIG. 12. Detailed drawing of proboscis of a male showing distinctive cowhorn-shaped single row of middorsal hooks.
- FIG. 13. Posterior extremity of gravid female showing copulatory cap.
- FIG. 14. Section of body of mature female anterior to copulatory cap, showing uterine apparatus.



## PLATE 54

*Nipporhynchus ornatus* (Van Cleave), *Gorgorhynchus clavatus*, new species,  
and *Southwellina hispida* (Van Cleave)

- FIG. 15. *N. ornatus*, anterior extremity of female showing characteristic form of proboscis and its hooks and arrangement of cuticular spines on body surface arranged in two distinct fields.
- FIG. 16. *G. clavatus*, posterior extremities of male and female in copula.
- FIG. 17. *S. hispida*, proboscis of mature male showing form of proboscis and arrangement of hooks. The body spination begins posterior to the region shown in this sketch.



## PLATE 55

*Nipporhynchus ornatus* (Van Cleave) and *Centrorhynchus spinosus* (Kaiser)

FIG. 18. *N. ornatus*, posterior extremity of male showing relations of testes, four cement glands, and everted bursa.

FIG. 19. *C. spinosus*, entire immature male showing differentiation of bodily regions.

FIG. 20. *C. spinosus*, proboscis of mature female and associated structures in anterior region of body.



